INAUGURAL ADDRESS,

DELIVERED IN THE

Chapel of the University at Cambridge,

DECEMBER 11, 1816.

BY JOHN GORHAM, M.D.
ERVING PROEESSOR OF CHEMISTRY IN HARVARD UNIVERSITY.

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ADVERTISEMENT.

THE Professorship of Chemistry and Materia Medica, was established by the University in 1783.

William Erving, Esq. who died at Roxbury, in May, 1791, aged 57, bequeathed a thousand pounds, lawful money, to the College, towards the support of this part of the institution, and his name was thenceforth annexed to the professorship. Aaron Dexter, M. D. the Professor, from the commencement of the Institution, having resigned the office, in August last, was, by vote of the Corporation and Overseers, exempted from the obligation of services in the office, but desired to retain his connexion with the University, with the title of Erving Professor of Chemistry Emeritus.

John Gorham, M. D. for several years Adjunct Professor, was chosen to succeed Dr. Dexter, and inaugurated, December 11, 1816.

ADVERTISEMENT.

Two years ago the branch of Materia Medica was separated from Chemistry, and, with Botany, assigned to a Lecturer, who is Jacob Bigelow, M. D.

The Professor of Chemistry, besides the course at the Medical College in Boston, gives a full course of lectures in Chemistry and Mineralogy, at Cambridge.

ADDRESS, &c.

The tendency of matter is to rest. All the motions of the particles of bodies with which we are conversant, may be regarded as so many efforts to equalize the forces which affect them; to constitute unchangeable compounds, and to reduce our globe to a state of eternal solitude, silence, and repose. But long experience has proved, that this equilibrium has not yet been produced, nor from the present order of things is it likely to happen. The general powers of nature, although they are never intermitting, are yet often unequal in their action; and it is to the varied operation of heat, of light, and of electricity, that we are to look for the cause of the complex and apparently irregular motions, which affect the different elements of matter, and determine the composition of the bodies observed on the surface of the earth. The atmosphere which surrounds, and the masses of water which float on the globe, are influenced by these powerful principles; they become secondary agents in the revolutions of the forms of matter, and produce the most general and important effects, either by their momentum, or the attractions of their component parts. Hence it is, that the surface, which is constantly exposed to the action of these powers, exhibits an endless succession of motions and of changes. The forms of matter are continually fluctuating, and the substance which, at one period, is solid, may at another exist as a liquid, or be

resolved into air. The properties of bodies are equally altered with their forms; their particles alternately unite and recede from each other; if compound, they are decomposed and their elements are made to assume new arrangements; if simple, they combine with other matter, and, in that state, are no longer to be identified. Every thing is in motion and activity; and, although the series of changes is sometimes slowly progressive, and, to a superficial observer, not always perceptible, it is, nevertheless, constant and uniform. It is the duty of the chemist to observe these changes and investigate their causes; to determine the nature of bodies, and reduce them to their elements; to ascertain their mutual actions and relations; and to apply the knowledge, acquired by observation and experiment, to the improvement of the arts which supply the wants, multiply the comforts, or administer to the luxuries of social life. Chemistry, therefore, is a science as important as it is extensive.

Like the other branches of physicks, which are founded on observation and experiment, the origin of chemistry is too remote to be distinctly traced; and it is obvious, that facts, which daily come within the cognizance of the senses, and which have an important influence on the existence, or the relations of life, must have early attracted the attention, although they did not lead to the investigation of their causes or connexions. But the physical truths which experience must have forced upon the ancients were unconnected, and we are not to look to them for the generalizations, which constitute a science. The early history of chemistry, therefore, presents nothing to the mind but the simple truth, that its progress must have been exceedingly gradual among a people, who, although remarkable for the powers of intellect and the refinement of taste, yet failed in their philosophy, because "they reasoned more upon an

imaginary system of nature, than upon the visible and tangible universe."* It would be a task, as irksome to me as uninteresting to you, to trace the progress of individual discovery and the gradual development of facts, from which the theories that now constitute the science of chemistry are deduced. A much more pleasing and appropriate subject may be found in the revolutions, which these theories themselves have successively experienced, as observations have been extended, experiments have been multiplied, and new facts have been accumulated. I propose, therefore, to confine myself to a cursory detail of the state of the science, as it has existed at different periods, and to conclude with a view of the philosophy of the present age.

The first opinions which may be regarded as an approximation to chemical hypothesis, were those of the alchemists, an extraordinary body of men, who flourished between the 11th and 16th centuries. During the period of the crusades, the warriors of the west, whose zeal was excited, and whose wealth was bestowed for the glory of the cross, gradually lost, with the success of their arms, the enthusiasm and spirit of chivalry which led them to Palestine. They saw themselves deprived of their possessions, reduced to poverty, and incapable of supporting their rank in society, and they willingly turned from the unprofitable fame of champions of religion, to the hopes held out to them by the impostors of the east, of the power of transmuting the metals into gold, and of obtaining immortality upon earth. They transferred the delusion from Asia to Europe, and thus gave rise to the study and pursuits of alchemy. The cultivators of this art may be considered as the forerunners of modern philosophy: with the spirit of physical research and experiment, which has distinguished their successors, they combined all the mysti-

* Sir Humphrey Davy.

cism of the Cabalist and the absurdity of the Dialectic school.

About this period the mind, under the guidance of the scholastics, had taken a wrong direction; and no system ever invented, could be more unfavourable than this to the pursuit of polite literature, or to the progress of demonstrative science. The lives of the learned men of the time were devoted to the art of disputation. They confounded each other, and confused themselves, by subtle and ingenious distinctions in terms; by a refined and speculative system of words; by recondite and sophistical modes of reasoning; and by their attempts to obscure the boundaries of science, and to unite physical with metaphysical subjects. Great minds were sacrificed in the pursuit of these illusions. Had such men as Thomas Aquinas, William de Campeaux, Albert of Cologne, and the unfortunate Abelard, who lives only in the numbers of the poet, investigated material nature with the same ardour, with which they entered the fields of controversy, and the same sagacity which they displayed in fixing the signification of a word, their labours would have been crowned with brilliant success, and their names with unfading glory. The alchemists explored a new and more fruitful subject. Leaving the study of logic, and the cultivation of the dialectic philosophy to those who aspired to literary fame, or ecclesiastical distinction, they commenced the practical examination of nature. But destitute of instruments, unused to methodical arrangement, and unacquainted with the processes of investigation which are required by the severer sciences; guided by enthusiasm and stimulated by avarice, the objects of their pursuit were as absurd, as the means they employed to obtain them were extravagant. They believed that the basis of all the metals is gold, and this class of bodies was tortured with the most persevering industry to discover the

art of removing the alloying substance, and of acquiring unbounded riches. They thought that it was in the power of human art to compound a liquid, which should renovate the frame, when impaired by time, or exhausted by disease, and be able to restore to the rigid and unyielding fibre of age, the bloom and elasticity of youth. They imagined, also, that nature had formed a substance of such astonishing powers, that no other body could resist its action; and the alkahest, or universal solvent, was looked for in the products of the crucible and the alembic, with the same anxiety as was exhibited for the elixir of life, and the philosopher's stone. On the subject of general physicks, they were less absurd. They rejected the four elements of the ancients, and supposed all nature to be composed of the three simple principles, salts, sulphur, and mercury. Such were the speculations and the pursuits of the alchemists. A feeble ray of light from the source of science would occasionally penetrate through the gloom in which they were enveloped, and conduct them to some important fact. The most distinguished among the alchemists was Paracelsus. This man possessed a bold and original mind, which, conscious of its powers, but just released from the trammels of the schools and the weight of ancient opinion, knew not how to direct its views, or limit its operations. He was the first public lecturer on chemistry in Europe; and this station, together with the reputation derived from the successful application of chemical medicines to the cure of diseases, afforded him the opportunity of attacking and of prostrating the dogmatic school of Galen. In his character were combined the extremes of arrogance and meanness, of the freedom of truth with the boldness of pretension, of enthusiasm of mind with great profligacy of manners. Yet he was, probably, an eloquent man. In his wanderings he was followed by a crowd of admirers; his

opinions, which were respected as the decisions of an oracle, were embraced with zeal, and disseminated throughout Europe; and although, notwithstanding he declared himself the possessor of the elixir of life, he expired, exhausted by his vices, at the early age of forty-two, we have sufficient evidence of his celebrity in the epitaph engraved on his tomb-stone, at Saltzburg.

> Divinus talis est Paracelsus in arte monarcha,
> Similem cui secula nulla tulere virum.

In reflecting on the influence which the pursuit of alchemy has had on physical science, it must be acknowledged, that it has been greater than would, at first view, have been imagined. It diverted the mind from the study of words, to the examination of things; and, as at that period, experiments on the nature and relations of bodies were altogether novel, it can hardly be supposed, that however absurd and impracticable the specific object of the alchemist might have been, he should not have arrived at new results, unexpected discoveries, and useful facts. We accordingly find, that to them belongs the merit of having demonstrated the properties of quicksilver and of antimony; of the three most important acids, and of ether; and of having introduced into medicine a variety of active preparations. When the knowledge of the nature of bodies became more accurate and extensive, and, more especially, when experience had demonstrated, that the pursuit of the philosopher's stone ended in poverty and disgrace, the belief in its reality gradually lessened, and the delusion terminated with the life of Libavius.

The theory, which, after some time, succeeded the speculation of the alchemists, originated in Germany; and that country, which has been recently stigmatized as the school of pedants, the abode of dulness, and the asylum of the

enthusiast, swayed, for nearly a century, the opinions of the chemists of all Europe. Beccher, who was born at Spires, in 1645, produced his two remarkable works, Physica Subterranea and Œdipus Chymicus, in which he advanced the bold and magnificent theory, that there exists in nature but one simple elementary principle, to which he gave the name of earth. This was divided into three species: the vitrifiable, the metallic, and the inflammable. Few facts, however, were, at that period, collected, to substantiate the hypothesis; and it was regarded, rather as the work of a brilliant imagination, than as a legitimate theory, founded on facts and susceptible of demonstration. It was reserved for Ernest Stahl, of Vienna, to build a simple, consistent, and beautiful system, on the original idea of his master.

But, previous to this period, a revolution, the most auspicious to the cause of physical science, had been completed. The mind, which had been so long depressed by ignorance and superstition, suddenly resumed the exercise of its powers. The weight was removed, and it rose by its own elasticity. Lord Bacon had already pointed out the only mode by which the faculties are to be assisted in the study of nature; and the greatest praise is undoubtedly due to him for diffusing, by his writings, the knowledge of this method, and the use of the means by which man is to attain to physical truths. But it must be remarked, that he wrote at a time when the mind was already prepared for his plan; and that a few works connected with science had already appeared, in which, although nothing is expressly said on the advantages arising from the method of induction, the subjects are treated of in the same philosophical spirit. The work of George Agricola of Germany, de re metallica, had been published eighteen years, when the British philosopher first saw the light. Learned societies were founded;

and zeal in the cause, and success in the pursuit of truth, were promoted by union of efforts. The Academy del Cimento at Florence, published a series of useful facts and valuable experiments. The Royal Society of Britain could boast of Slare, of Boyle, and of Hooke; and the French Academy of Homberg, Geoffroy, and the two Lemery's. The most important instruments of physical research were rapidly succeeding each other, and the gravity of the air, which had been demonstrated by Gallileo, and measured by the Barometer of Toricelli and Paschal, was merely an introduction to the knowledge of its other mechanical properties, obtained by the air-pump of Otto Guerick and Sir Robert Boyle. The Florentine Academicians and Mr. Boyle gave to philosophy the thermometer, and many of the numerous relations of heat were soon unfolded. Newton first raised chemistry to the dignity of a science, by applying to the particles of matter his general principle of attraction; and not long after the knowledge of the relative forces of attraction in different bodies was rendered definite by the tables of Geoffroy. At this period, the attention of philosophical minds was withdrawn from the investigation of the elements and mutual actions of bodies, and chemical research was retarded. The sublime views which the philosophy of Newton unfolded, of the motions and relations of the celestial system, and the profound demonstrations which it exhibited in the higher mathematicks, not only allured the attention, but excited the enthusiasm of every man of science. Astronomy was cultivated with all the ardour which had before been devoted to chemistry, and men turned, with something like contempt, from the examination of the matter on which they trod, when the sublime machinery of the universe was opened to their view. But as the system of this great philosopher became familiar, and mechanical

philosophy assumed the form of a science, the actions of the particles of bodies again attracted notice. Practical chemistry was pursued with the zeal, which arose from the conviction of its usefulness, and with the pleasure which is derived from gratified, but unextinguishable curiosity. It was at this period, when the nature and properties of a multitude of substances were accurately known; when the processes of the chemist were refined by a correct judgment, and conducted with much manual dexterity, that Stahl produced a theory which excited the admiration and commanded the assent of all Europe.

The process of inflammation is so intimately connected with chemistry, that a theory of combustion was, for a long time, supposed to constitute the science itself. It was thus, in a great measure, regarded by Stahl. He inferred, that there is a principle existing in all combustible bodies, which may be considered as the cause of their inflammability. This principle, which was supposed to be more attenuated than the earth of Beccher, or the ethereal fluid of Newton, and analogous to light, heat, or pure fire, he called phlogiston. He assumed, that while bodies are burning, the phlogiston is in the act of disengagement; that when it is completely evolved, the body is burnt, and, in that state, is incapable of going through the same process a second time; that phlogiston may be slowly disengaged without the usual phenomena of combustion, by which the theory was extended to other chemical operations; that the light and heat observed in active inflammation, are the results merely of the violent motions of the particles; and, lastly, that phlogiston may be silently transferred from one body to another, the former losing, and the latter acquiring the property of combustibility. This simple and elegant theory was supported by so many well chosen experiments, it was arranged with such consummate skill, and exhibited

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throughout such proofs of a cautious and philosophical spirit, that it received unlimited assent, and was publickly taught with the same conviction of its truth, as was accorded to the demonstrations of Sir Isaac Newton.

But the period of rigid chymistry was approaching, when philosophical minds were to be satisfied only by demonstrations. The existence of phlogiston was hypothetical, and the belief in its reality was continued, rather from the ease with which it enabled chemists to explain the phenomena of the science, than from any precise knowledge of its nature, or any actual experience of its properties. This difficulty, together with the important fact announced by Rey and others, but overlooked by Stahl, that bodies increase in weight while burning, gradually weakened the enthusiasm in its favour. It was necessary either to reject it altogether, or so to modify it, that it should be applicable to the new facts. Fortunately for its reputation, the discovery of the elastic fluids, and particularly the demonstration of the properties of hydrogen, furnished the chemists with an agent, the nature and properties of which had been accurately unfolded, and which might be substituted for the imaginary phlogiston of Stahl. This principle then was supposed to be essential to the combustibility of bodies, and when it was disengaged in the act of burning, its place was supplied by oxygen. The augmentation of weight was satisfactorily accounted for, and the theory was again completed. It only remained to demonstrate the existence of hydrogen in all combustible bodies; but this was beyond the art of the chemist. It was in vain, however, that such men as Cavendish, Kirwan, and Priestley laboured to establish the modified theory of Stahl, on a permanent and unchangeable basis. The tide of popular opinion had already turned in favour of the French system. It gradually receded from view, and was suffered to repose,

at least for a time, with the ashes of the celebrated and unfortunate Priestley.

The system which was erected on the ruins of that of Stahl, originated in France, and its author was Lavoisier. No man perhaps was better calculated to give currency to new opinions. Enjoying all the influence which political distinction, a splendid fortune, and the reputation of uncommon talents can bestow; trained for the severer studies, by an early and judicious education; well acquainted with the science of the age, and already distinguished as a zealous cultivator of philosophy, he carried into chemistry all the precision of the exact sciences, and reasoned on their phenomena with the caution of the geometrician. He knew how to avail himself of the labours of others, and his doctrines were founded on the discoveries of Black, Cavendish, Priestley, and Scheele. The basis of his theory is founded on the phenomena which oxygen exhibits in its combinations with other bodies; and the enunciation of the doctrine itself is unfolded in the simple propositions,

That combustion will not go on without the presence of oxygen.

That in every case of combustion this air disappears, the burnt body increases in weight, and the weights thus lost by the one and gained by the other, are precisely equal; that combustion, therefore, is the act of union of the inflammable body with oxygen.

That oxygen is the principle of acidity.

That it may be transferred from one substance to another, without the usual phenomena of inflammation, and

That the heat and light, both of which are regarded by him as material, and which are disengaged during the combinations of this gas, are the results of the difference of capacity between oxygen air, and the product of its union.

Such was the simple, consistent, and beautiful system of Lavoisier; but notwithstanding the high reputation of its

author, and its adaptation to the facts which were at that time accumulated, he could not, for a long time, boast of a single convert. It was at length embraced by the distinguished chemists of France; it gradually forced its way into Great Britain, and was finally adopted, although not without opposition, throughout Europe. This revolution, however, in the philosophy of chemistry was not yet completed. The language employed in this science was derived, either from the Arabic, or from the more fantastic and barbarous phraseology of the alchemists. The names imposed upon recently discovered bodies were perfectly arbitrary. The entire change, or at least the reform of nomenclature was universally acknowledged to be necessary, and the period chosen for this change was peculiarly favourable to its diffusion and adoption. The labour was undertaken by Lavoisier, and, in conjunction with Morveau, Fourcroy, and Berthollet, he published in 1786, a new nomenclature founded on his own system, and deriving its radicals from the language of the Greeks. From this time, the reputation of French philosophy was identified with the success of the new system, and by methods, equally judicious and ingenious, it gradually became the language of all the chemists of Europe.

This nomenclature is founded on the nature and the number of the elements of which bodies are composed, and it must be acknowledged, that it was simple and uniform, adapted with exquisite skill to the state of chemical knowledge at that period, and applied with the greatest ingenuity to the different forms of matter. Had chemistry been circumscribed, and its limits accurately known, it would have remained an everlasting monument of the science and sagacity of Lavoisier and his associates. But it was premature. In proportion as novel facts are developed, and as new elements are discovered; in proportion as the

art of analysis is refined, and we approximate to the knowledge of the real nature of bodies, it is obvious, that a theoretical and composite nomenclature must be equally varied to correspond with these changes. As chemistry is a science founded on experiment, no bounds can be set to its progress, nor, consequently, to the language which, like that of the French system, is intended to illustrate the nature and composition of bodies ; and it must, therefore, sooner or later, lose, with the theory itself, the qualities which led to its adoption, simplicity, precision, and consistency. Such will be, nay, I may venture to say, has been the fate of the system of Lavoisier. Oxygen is not the only supporter of combustion ; it is not the principle of acidity ; it is not the source of the light, nor, in all cases, of the heat, evolved during its combinations, and it is hardly the rival of hydrogen, or the phlogiston of Kirwan and Priestley, in the number of its combinations, or the importance of its phenomena. It is already fallen, and the future chemist will regard it with the same mixed feeling of admiration and regret, with which the scholar contemplates the ruins of the Grecian temple, over which time has passed his relentless hand, has withered its beauty, and levelled the harmonious structure with the dust.

To account for this rapid downfall of the French philosophy, it will be necessary to take a cursory view of the present state of chemical knowledge.

Since the commencement of the 19th century, more has been done to place the science on a permanent basis, than had been effected by all the labours of preceding chemists. The grand discovery of Volta, that Galvanism, by certain arrangements of different metals, may be accumulated to an almost indefinite extent, has given to the chemist an agent of great power in producing decompositions, and in arriving to the elements of bodies ; and the application of vol-

taic electricity to different forms of matter, opened to Sir Humphrey Davy a glorious career, and crowned him with unfading reputation. He has not only discovered a number of important elements, and given probability to the hypothesis of an universal inflammable principle, but, what is of more consequence, he has nearly established the general truths, that the mutual attractions of the particles of different matter are proportional to their electrical energies; and that those which obviously have the greatest tendency to combine, are such as also exhibit the most opposite states of electricity. So great and decided is the number of facts to support this opinion, that Berzelius, the distinguished chemist of Sweden, has boldly published a system founded upon the electro-chemical energies of bodies. This may be considered as an important step toward the completion of the science; for, instead of the obscure and indefinite idea of attraction, and of a power which is unseen and unknown, chemists will now recognise the agency of a principle, which may be accumulated or discharged at will, the properties of which may be accurately demonstrated, and which, when it acts on masses, instead of the atoms of matter, is known to produce some of the most sublime and magnificent phenomena of nature.

It is not a little remarkable, that chemistry, although it is founded on experiment, should not, until the present moment, have assumed the form of an exact science. The play of attractions has been supposed to vary so much by the circumstances in which bodies are placed, and so much uncertainty has appeared to exist, relative, either to the general results, or to the proportions in which they unite, that it has been said, experiment alone can enable us to acquire any positive knowledge on the subject. This uncertainty will no longer exist, and by far the greatest improvement which has yet been made in this science, is the

discovery of the general truth, that bodies combine in definite proportions. The atomick theory is the production of the present age; for although some of the facts were unfolded by Dr. Higgins, the merit of the generalization belongs to Mr. Dalton of Manchester. It infers, that bodies are composed of atoms, which are not mathematical, but physical points, and are, consequently, possessed of extension and gravity; that these atoms unite with each other in one or more proportions in simple ratios, and, as has been proved by experiment, that the higher proportions are multiples of the first. By this simple law, chemistry is at once made to take rank with the physical sciences which are founded on the mathematicks. The relative weights of the atoms of different bodies may be estimated, the proportions in which they combine may be accurately defined, and calculation may thus be made to correct, or supply the deficiencies of experiment. The theory of volumes which has arisen from the discoveries of Dr. Higgins, and of Gay Lussac, and been adopted by Sir H. Davy, is equally founded on the laws of definite proportions, and applicable to all the phenomena of true chemical combination.

Another subject which appears to be connected with the electrical energies of bodies is crystallization. The fact, that the immense variety of crystals which are disseminated throughout nature, may be reduced, by mechanical division, to a few primitive and elementary forms, which was suspected by Bergman and De Lisle, has been demonstrated by Haüy; and the crystallographical researches of this philosopher have unfolded to us one of the most beautiful and recondite processes of nature. The cause which produces these crystals, is without doubt, the power which gives polarity to their atoms. It is thus connected, on the one hand, with mechanical philosophy, and on the

other, with chemical science. The laws of crystallization, of definite proportions and of the electrical energies of bodies, says Sir H. Davy, seem to be intimately related, and the complete illustration of their connexion will probably constitute the mature age of chemistry.

Chemists have penetrated into all the departments of nature, and no subject has been investigated with more zeal, and I may add, with less success, than the chemistry of organized beings. The various actions which take place among the elements of vegetables and of animals, the numerous changes which they undergo, the variety, and peculiarity of their products, and their nice adaptation to the purposes for which they are supplied, could not fail to attract the attention, and engage the researches of men, who were already familiar with the properties and composition of common matter. The right of explaining the functions of the living body was assumed by the chemists; and the physiologist was no sooner relieved from the absurdities of the mechanical doctrines, than he was bewildered in the mysteries of chemical affinities. The component parts of the human body have been analyzed with the most scrupulous exactness. Man has been reduced to a few simple principles, or elements, and the changes which take place during life, have been explained with the same ease as those, which disorganize the body after death. Nay, the zeal of the chemists has carried them so far, that they have attempted to compose some of the proximate principles of animals by mixture, or by the powers of voltaic electricity. There are some, in this country, who have thought, and have even published the brilliant idea, that the chemist may soon be able to crystalize a man, and animate his crystal by the agency of electric matter. It would be useless to attempt to refute an opinion so absurd and so impious. The laws

of animated nature do not appear to be the same with those of chemistry, and the impotence of the chemist, in this department, is clearly evinced by the single fact, that, notwithstanding all the analyzes which have been made, he has not yet succeeded in producing a single compound, similar in every respect to any of those which are elaborated in the living system. The powers which regulate living matter, seem to have no other connexion with those by which inanimate nature is governed, than in operating on the same elements. These materials are combined in different ways, and by methods which the laws of chemistry cannot control, and in which their part, if any can be allowed them, is feeble and subordinate. The actions and combinations which produce digestion, assimilation, secretion and respiration, are vital. They no more belong to chemistry, than the properties of common matter make a part of vitality, and vital affinity is probably as distinct from chemical attraction, as sensibility and irritability are from extension and gravity. The departments of the chemist and of the physiologist are well defined. Living matter is the property of the latter, inert inanimate nature of the former.

Such is the present state of chemistry. It is distinguished from all other periods of the science by the probable unalterability of its philosophy. The theories of definite propositions, of the electrical energies of the particles of bodies, and of the operation of the powers, concerned in the production of chemical phenomena, constitute what may strictly be called the science; and, however individual facts may be multiplied, or its processes refined, its laws, founded on experiment and supported by the mathematicks, must remain unchangeable. Combustion which, for so long a period, was considered as the science itself, now takes a subordinate rank. Hydrogen has been

discovered to constitute a part of all classes of bodies, except the metals, and should they be proved to contain it, the doctrine of phlogiston must be renewed in a demonstrable and permanent form. Oxygen is not the principle of cidity, for it forms an essential element of bodies, which are alkaline; nor is it the only supporter of combustion, for this property belongs also, to two other bodies, chlorine and iodine.

Were I permitted to exceed the usual bounds of a discourse on these occasions, I should dilate, with the greatest satisfaction, on the intimate relation which exists between chemistry and the arts; and on the important advantages which have resulted from the application of philosophical principles to the improvement of the most useful and familiar processes. Nor should I forget to impress on the minds of those who are, or may be engaged in the study of medicine, that the road to fame, in this profession, leads through the fields of natural history, of chemistry, and of mechanical philosophy; and that the reputation of Boerrhaave and Cullen, of Fothergill and Fordyce, of Rush and, may I add, of Warren, was founded on the knowledge of the collateral branches of medicine. But I must forbear.

Chemistry, then, is a science of experiment, and its object is to discover the elements and the relations of bodies. When it is recollected how many distinguished men are now engaged in these pursuits; with what zeal they advance through new, and hitherto untrodden, paths; with what delicacy and precision they operate, and with what discoveries their labours have been already rewarded, it must be acknowledged that, although rapidly progressive, no limits can be assigned to this science. In proportion as the instruments, with which they operate, are increased in power or improved in construction; and in

proportion as the habits of accurate observa cautious reasoning are cultivated, new elemen discovered, or those, which were once regarded as will be proved to be compound. The number of c of simple substances will be reduced ; it will be found the great Author of nature operates with fewer mater than has been supposed ; and, possibly, the sublime idea the ancient philosophers may be verified, that there exists but one simple primitive form of matter, the element of all nature. Chemical investigation has already approximated to the conclusion, that matter may be divided into the two classes of oxygen and the metals ; and should the opinion, which is now held by many, respecting the constitution of some of the elastick fluids, be proved, as it probably will, to be correct, all the powers engaged in the production of chemical phenomena, and all the elements of bodies may be reduced to radiant matter, to the supporters of combustion, to the acidifiable bases, and to metallick bodies. An arrangement like this, of the substances which constitute, and of the powers which act on the globe, cannot fail to strike the most superficial observer with admiration and awe, and it leads us at once to the conclusion of Sir H. Davy, that the more the phenomena of the universe are studied, the more distinct their connexion appears ; the more simple their causes, the more magnificent their design, the more wonderful the wisdom and power of their author.

THE END.